Stupka June 1954

Mourning Dove Populations In North Carolina

Wildlife Resources Commission, Raleigh, N. C.

MOURNING DOVE POPULATIONS

In

NORTH CAROLINA

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Federal Aid In Wildlife Restoration Program

North Carolina Project W-30-R

GAME DIVISION

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

RALEIGH, NORTH CAROLINA

June, 1954

STATE OF NORTH CAROLINA

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Foreword

The increasing amount of hunting pressure during the past several years has made more and more obvious the need for detailed information basic to the management of the mourning dove in North Carolina and the Southeast. Since the dove is a migratory game bird (and therefore under the jurisdiction of the United States Fish and Wildlife Service), a cooperative investigation was initiated in order to study the characteristics of, and factors affecting, the population over the entire southeastern region. The study was designed and directed to secure factual information which could be used as a basis for improved management which, in turn, would provide a maximum harvest without endangering the population.

The combined effort which characterized the study resulted in knowledge which would have been many years forthcoming through one or more states working separately. Information which was obtained from the North Carolina Wildlife Resources Commission's phase of the study has been compiled and summarized and the final detailed results have been submitted to the Atlanta office of the Fish and Wildlife Service for use in the preparation of a composite report for the entire cooperative investigation.

The present bulletin is prepared primarily from the factual information which was obtained under North Carolina's project. The results of this work are presented here as a report to the sportsmen and people of the State, for their information and use in acquiring a clearer understanding of the principles involved in sound mourning dove conservation and management.

Clyde P. Patton

Preface

Prior to the initiation of this study considerable data had been accumulated on life history; hence, the new need was for facts on population characteristics and trends from which sound decisions could be made regarding hunting regulations and other phases of dove management. In the Spring of 1948 the Southeastern Association of Game and Fish Commissioners passed a resolution which led to a cooperative region-wide search for these facts. In September 1948 the project was initiated, and during 1949 ten southeastern states became actively engaged in the investigation, under the Federal Aid in Wildlife Restoration program.

These states included Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee. At the request of the States, coordination and supervision of the projects were assumed by the Atlanta office of the United States Fish and Wildlife Service with aid from the Wildlife Management Institute. During the course of the coordinated study, which continued in full effect through 1952, approximately 25 eastern and mid-western states and several other agencies and individuals participated in varying degrees by providing information from other parts of the dove range.

The North Carolina study, Federal Aid Project W-30-R, began in August 1949 and continued through February 1953 under Project Leader Donald G. Allison. Many other persons of the North Carolina Wildlife Resources Commission were associated with project activities in various ways. In addition to routine assistance rendered by project supervisors and administrators, Game Division project leaders and district biologists aided in obtaining valuable data in regard to population trends, production, and mortality. Members of the Wildlife Protection Division assisted in hunter bag checks, inventories, and disease reports. Wildlife students at North Carolina State College and selected 4-H Club members were primarily responsible for banding stations operated in ten counties. Personnel of the State College Poultry Disease Laboratory rendered valuable service with respect to diseases of doves. All of the information collected during the North Carolina investigation was summarized in tabular and graphic form by Project Leader Allison. Upon Mr. Allison's resignation in the latter part of 1953, the services of Dr. Thomas L. Quay, North Carolina State College, were acquired for the pur-

pose of preparing the final report and this publication. Photographs were provided by Jack Dermid, Commission Photographer, and sketches were prepared by Will Hon, graduate student in Animal Ecology at North Carolina State College.

The general objectives of the cooperative investigation, as prepared by the Fish and Wildlife Service, emphasized the study of population densities, distribution, and movements; breeding and production; and mortality factors, including the effects of hunting. Initial work included the development of suitable methods for obtaining information on these points. Trapping techniques were developed and improved, roadside counts and breeding censuses were developed which would give indices to population trends and annual production, and hunting and other mortality factors were evaluated as to their effects on the status of the population. Analysis of band returns has given valuable information on population peaks, migration, movements, and turn-over.

This publication presents the results obtained in North Carolina from cooperation in the regional study, combined in part with some of the results obtained from former work done in the State (Quay, 1951). The composite results of the region-wide investigation have been tentatively summarized and prepared as a four-year *progress* report by the Atlanta office of the Fish and Wildlife Service. This will probably be followed by a *final* report when it is felt that sufficient additional data have been compiled.

Although the overall project as originally conceived has been completed, many of the same agencies are continuing certain phases of the study. Random road-counts are being continued in order to determine annual trends in the population, and spring cooing-count censuses are used to obtain an index to breeding activities, which, in turn, give an indication of the production potential for the year. Hunter bag checks have been continued in order to determine the degree of late breeding and the adult-immature ratios. Banding operations are still being conducted in order to further clarify migration and local movements, to determine the degree of site tenacity, and the annual turn-over in the dove population. These studies are being continued so as to "keep a finger on the pulse" of the population, as well as to determine the effectiveness of regulations in maintaining maximum shootable surpluses.

T. Stuart Critcher

"More Sport for More People.

Equal Opportunity for All."

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Life History and Habits

As the days grow longer and warmer in late January and early February, mourning doves in North Carolina start cooing and making their circling, courtship flights. The break-up of flocks and the formation of pairs are frequently slowed down and even temporarily reversed by spells of cold and blustery weather. But the increasing length of day is the primary controller of spring activities, and early nesting by local doves is well under way even as the regular northward migration of the main population draws to a close.

Egg-laying begins in March and lasts into September, for the longest nesting season of any bird in the United States. Nesting activity is greatest, however, during April, May, June, and July. In normal seasons, nesting is around 90% complete by the end of August.

Mourning doves nest in the wooded edges of fields, pastures, and clearings, and in the trees around farm buildings and suburban areas. Only on the treeless islands at the edge of the ocean do mourning doves nest on the ground in North Carolina. Most nests are between five and twenty feet above the ground, loosely placed in such forks, crotches, brush, and vines as provide level support and a little cover. The favorite nesting trees are loblolly pine, short-leaf pine, and red cedar. Other plants commonly used for nest sites are wax-myrtle (Coastal Plain), Japanese honeysuckle, white pine (Mountains), white oak, post oak, red oak, red mulberry, sweet gum, apple, black cherry, flowering dogwood, and black gum.

Each completed nesting requires about one month from nest-building and egg-laying to fledging. Thus, it is theoretically possible for each pair of adult doves to raise five or six broods during the long season, not allowing for any time lapse between nestings. This number is rarely realized, however, because about half of all nesting attempts end in failure. Unseasonably cold weather, winds, storms, drouth, natural predation, disease, accidents, human interference, and perhaps other causes take their toll, as they do with all kinds of wildlife. The successful raising of one

FIGURE 1. Both parents tend the nest, the male by day and the female by night. In this unusual photograph, the female (band on right leg) is coming in to relieve the male at the late-afternoon exchange period. Most doves make their own loose nest of twigs and straw, but this pair took over an old robin's nest.

to three broods per summer would be the expected average for most nesting pairs.

Newly-fledged birds remain in the vicinity of the nest for a week or two, receiving some care from the parents and becoming stronger on the wing. Afterwards they join with others of their kind to form growing and shifting flocks in open fields and woodland borders. As the juveniles begin their independent lives in the open they are nearly full grown, weighing three and one-half ounces on the average as compared with four and one-half ounces for September adults. Normally they attain adult plumage at 17 to 18 weeks of age, but do not begin to mate until the following season.

Mourning doves are gregarious birds, going about in loosely-organized flocks when not nesting. They are relatively easy to approach at all seasons and do not display the wariness of the bob-white quail or wild turkey. Though migratory, doves are primarily dependent on farms and farming both for nesting range and feeding grounds. They are exclusively seed-eaters the year around, feeding largely on waste cultivated grains and legumes and on a variety of wild grasses and other plants common in and around farm fields. Feeding is done on the ground in

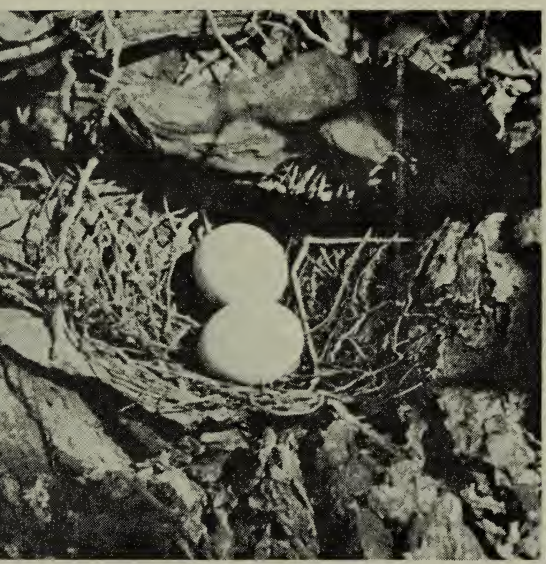


FIGURE 2. Mourning doves lay two white eggs, which hatch in fourteen days.

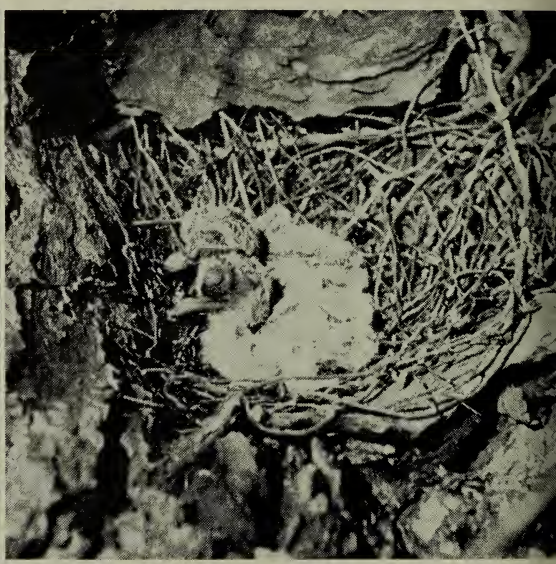


FIGURE 3. The young are blind and helpless at first, but grow rapidly and are ready to leave the nest in about two weeks.

FIGURE 4. The nestlings feed by putting their bills into the mouth of either parent and swallowing a regurgitated mixture of "pigeon milk" and seeds.

fairly open places. The seeds must be plainly visible and easily accessible, as these soft-footed birds do not scratch for their food. Doves alternately feed and rest during the day and flock to some regular watering place late in the afternoon. They roost in flocks in the pine and mixed woods bordering the feeding fields.

The growing variety of farming operations in North Carolina is providing these outstanding game birds with better food distribution and increased range, to the benefit of the overall population.

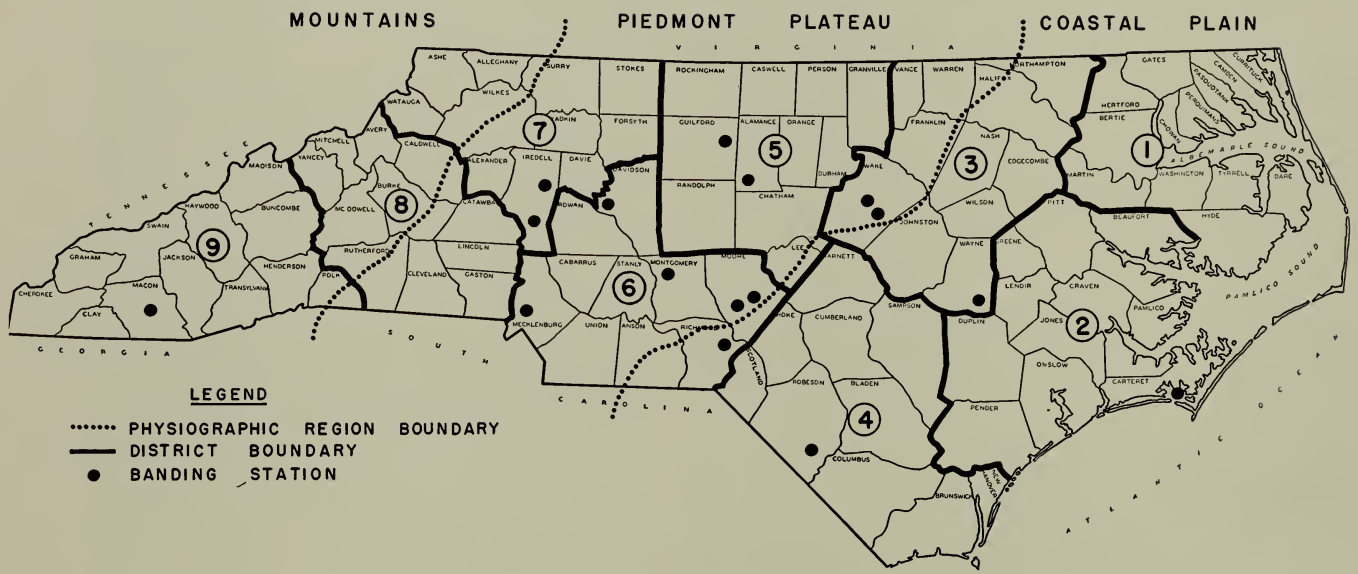


FIGURE 5. Physiographic regions, Wildlife Commission districts, and dove banding stations. Most of the banding stations were located in the Piedmont and upper Coastal Plain, the regions of greatest dove abundance. 5,636 different doves were trapped, banded, and released between August 1949 and February 1953.

Seasonal Residence and Movements

Range

The eastern mourning dove breeds in every state east of the Great Plains. The main wintering grounds are in the southern states from North Carolina to Texas, and especially in Georgia, Florida, Alabama, Mississippi, and Louisiana. Mourning doves are now hunted as game birds in fifteen states east of the Mississippi River, from Florida and Louisiana on the south to Pennsylvania and Illinois on the north. The more northern of these states have hunting seasons only in the early fall.

The Cooperative Mourning Dove Study has discovered that there are two main migration routes. Doves raised between the Atlantic Coast and the Appalachian Mountains migrate southward to the Gulf Coast and spread westward to Texas. Doves raised in the Mississippi Valley states migrate southward to Texas and the Gulf Coast and spread eastward to Georgia and Florida. Georgia appears to have more northern-raised doves in winter than any other southeastern state, receiving them from both the Atlantic and the Mississippi routes. Thus North Carolina is not within the region of heaviest wintering concentration, which may explain why dove hunting in this State is not as successful in mid-winter as in early fall.

Population Segments

The overall population of the eastern mourning dove apparently is composed of a number of segments, distributed not only geographically but also seasonally. Much banding work is yet to be done to determine the size, seasonal locations, and migration routes of these various groups. Such information can have important bearing on management procedures in the different parts of the total range.

North Carolina's annual dove population is composed of at least four different segments with regard to residence status. The smallest group would be the relatively few *permanent residents.* These birds are probably the first to start nesting. The next largest group is made up of birds present from late in November or December until sometime in February, March, or April. These are the most irregular in number, time of appearance, and length of stay, and are classified as *winter residents.* The largest

FIGURE 6. Mourning doves in trap. Extensive trapping and banding provide basic management information on residence status, movements, population size and composition, production trends, and turnover rates. The insert is a close-up of one of the numbered aluminum bands used in the program, under the license and direction of the United States Fish and Wildlife Service.

segment is the *transient population* which migrates through the State in spring and fall, nesting to the north and wintering to the south. The *summer residents* are the fourth segment, coming to us from wintering grounds farther south. This is the most stable group, busily engaged throughout the four-to-six-months season in producing the new crop of the year.

These four major residence segments tend to overlap and intergrade. They are further complicated by each being composed of birds from more than one geographical area. Additional information on the sources and movements of all the segments will allow more intelligent management than is now possible.

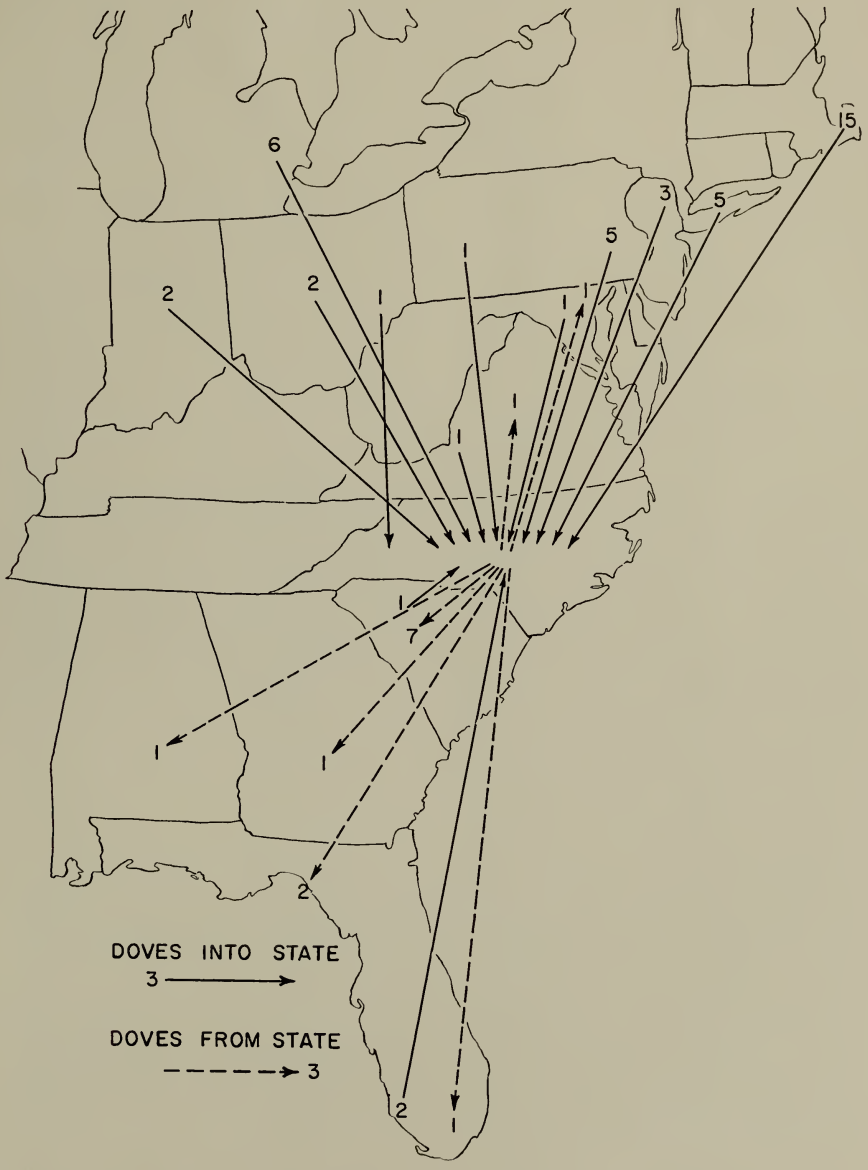


FIGURE 7. Banding recoveries (59) between North Carolina and other states, 1920-1952. The arrows are drawn between the approximate points of banding and recovery. Most band recoveries in North Carolina are made during the fall hunting season, as northern doves are migrating southward.

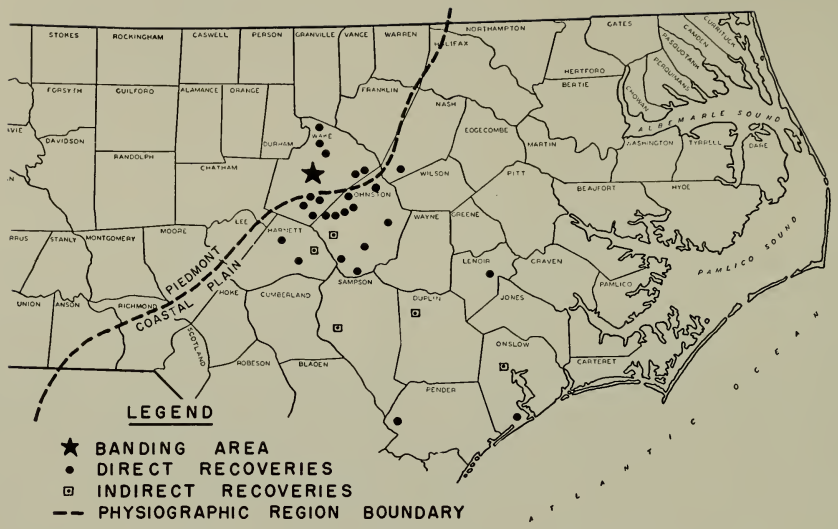
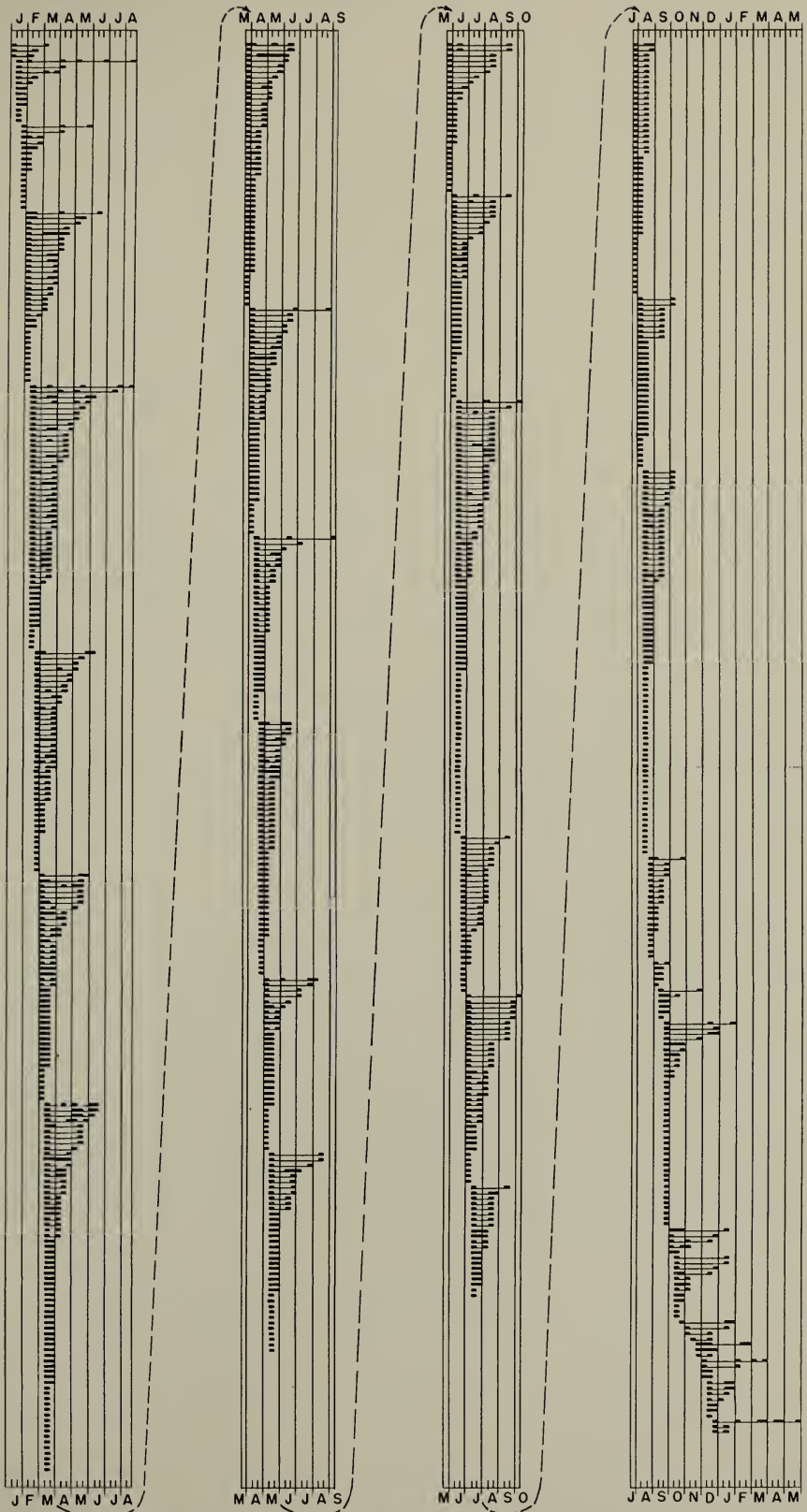


FIGURE 8. In-state recoveries of 30 doves banded at Raleigh, 1940-1952, showing movement south and southeast into the Coastal Plain. Eighteen of these doves were immature when banded and 12 were adult. Excluded are 93 recoveries which moved 5 to 8 miles east or west between Raleigh stations. (A "recovery" is a bird retaken at any time, dead or alive, *more than 5 miles* from the original banding station. Similarly, if retaken *less* than 5 miles from original station, it is (1) a "return" if in *more* than 90 days, or (2) a "repeat" if in *less* than 90 days from time of original banding.)

FIGURE 9. Known length of stay in the State, as shown by 991 retrap (same station) and recovery records of less than 90-day interval. Mourning dove populations in North Carolina are unstable and shifting, with some migratory movements underway most of the time by either adult birds or young of the year.

(The horizontal scale is in successive 10-day periods starting in January. The presence of each dove is indicated by a heavy line in the appropriate period. Only doves which were retaken at least once after banding are shown and only those from which retakes were within 90-day intervals. The 5-year totals from all trapping are combined and grouped vertically by date of original banding, with individuals of longest stay at the top of each group.)

(In bird-banding work, a bird retaken in the same area within 90 days of original banding is considered to have been present the whole time. If retaken after a 90-day interval, it is considered that the bird could have left the area in a migratory movement and later returned. Ninety days, of course, corresponds to a season—winter, spring, summer, or fall.)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Known Length of Stay

In view of the foregoing discussion, it is not surprising that the mourning dove population of any one place is characteristically shifting and unstable. This pattern is graphically illustrated for the State as a whole in Figure 9.

Only 17.6% (991 of 5,636 doves banded) were retaken at least once in the State within 90 days of original banding. Counting just those doves (2,846) banded at 14 stations in continuous operation for 120 days or more, 22.2% were retaken in the State within 90 days of original banding; the average known length of stay for this group was 27 days. It is believed that such figures are more indicative of short residence than of trap shyness. Doves enter traps readily and large numbers of individual doves are retaken at frequent intervals. In Figure 9, the longer stays to be expected of summer adults are masked out by the ever increasing numbers of juveniles. Also, nesting birds probably spend very little time in the open fields around the traps, and well may be more trap-shy than juveniles or non-breeding adults.

Rate of Return to Same Area

Mourning doves have a strong tendency to return to the same area from one year to the next. Both adult and young doves exhibit this site tenacity in about the same degree. It seems to be equally true, also, of spring and fall transients, summer residents, and winter visitors.

The measurement of this homing instinct is provided by the banding records. The annual rate of return to the same local area for the 2,846 doves banded at the stations in continuous operation for at least 120 days was 26% (calculated as a percentage of the birds expected to be alive to return in succeeding years). The station in Iredell County was operated almost continuously for over three years. The Wake County station was in operation each year from February to early September. The annual return rates for these two stations, calculated as above, were 38% for 1,134 doves in Wake County and 39% for 546 doves in Iredell County. There is reason to believe that the actual return rate is even higher than these figures indicate.

Populations Around the Year

The relative size, composition, and activities of the state-wide dove population were subjects of chief concern throughout the four years of the present study. Many methods were tested, the most fruitful of which proved to be trapping and banding, random and controlled roadside counts, censuses of cooing doves in the breeding season, hunter bag checks, and general field observations. On the basis of the combined results of all these methods, an overall picture can be presented as it actually develops in the field with the changing seasons.

Late Fall

There are fewer mourning doves in North Carolina during October and November than any other time of the year. The lowest point usually extends from about the second week in October to the middle of November. The number of flocks rather suddenly increases in all sections of the State in late November. Most flocks contain between 5 and 30 birds each but some number up to 500 birds. These flocks are thought to be the last migrants from the north, as they almost always appear following short spells of wintry weather. Many of them apparently stay in the State only a short time, passing on southward. This movement continues into December, the exact dates varying somewhat from year to year. In 1951, a poor production year, the low continued throughout all of November.

Winter

The December-January-February dove population is the most unstable and irregular of the year. There is a gradual increase in total numbers during December and January and a pronounced increase in February. A large portion of these new birds undoubtedly come from the south, at least the later ones. Numbers are highly variable from day to day, so that on many days in many places no doves at all can be found. Flocks are usually of less than 15 birds, but some flocks have as many as 150-200 individuals. On February 27, 1952, an immense concentration of approximately 4,000 doves was reported in the "wool grass savannah" of Beaufort County by Robert Halstead, United States Game Management Agent.

During this period there are practically no doves in the Mountains. The largest numbers appear to be in the central

Piedmont, and the next largest in the upper Coastal Plain. Likewise, there are noticeably greater concentrations in the southern counties of both the Coastal Plain and the Piedmont than in the northern counties of these regions.

Toward the end of January it becomes evident that the annual northward migration is beginning. This gets well started in February, co-incident with the first signs of nesting activity.

Spring

Migration rises to a peak in March. Numbers are variable on through April, however, while the last winter residents and transient migrants are leaving the State.

Egg-laying gets off to a general start in late March. Nesting activity rises steadily during April, as more and more doves establish themselves on breeding grounds. The nesting population of the year becomes fairly well stabilized by early May. At this time there are no real flocks to be seen and only singles and pairs dot the landscape.

Early Summer

Nesting is at the highest level during May and June, decreases somewhat in July, and drops off rapidly in August. Possibly 80% or more of the hatch is completed by the end of July. There is good evidence that late nesting attempts are more successful on the average than earlier ones.

Since spring migration and the beginning of nesting overlap for several weeks in March and April, the time when no flocks are to be found is limited to a relatively short period around the first of May. The results of early production are evident by mid-May, with the first appearance in the fields of small flocks—6 to 10 birds each—of newly-raised juveniles. Thereafter, growing flocks of juveniles become widespread in all sections of the State wherever suitable feeding fields are available.

The June and early July population does not continue to enlarge locally in proportion to the production known to be taking place. There is much movement and instability among these flocks of young birds. Flocks as large as 150 birds just disappear from the vicinity one day to the next. The roadside censuses, banding records, and general field observations all suggest that at least many of the new birds of the year start drifting southward soon after they are raised.

Late Summer and Early Fall

August and September bring the fall migration, and the largest dove populations of the year. There is a marked influx of both young and adult birds from the north, coming to a high point in late August and early September. Local young from late-season nesting and most of the summer-resident adults now flock in the fields with the transient doves. The very greatest numbers of doves from all sources are present during the first week or ten days in September.

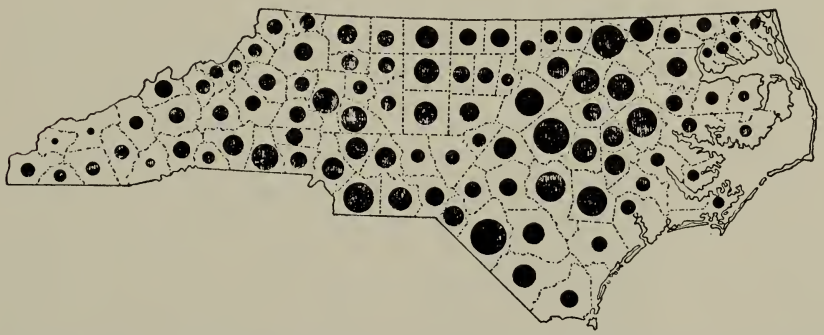


FIGURE 10. North Carolina cropland. The dots show the relative amounts of cropland in each of the State's 100 counties. Two broad belts of cropland extend diagonally across the State, one in the upper Coastal Plain and the other in the central Piedmont. (Reprinted by special permission from *Inventory of Land Use in North Carolina*, Tech. Bull. No. 93, Nov. 1950, North Carolina Agricultural Experiment Station.)

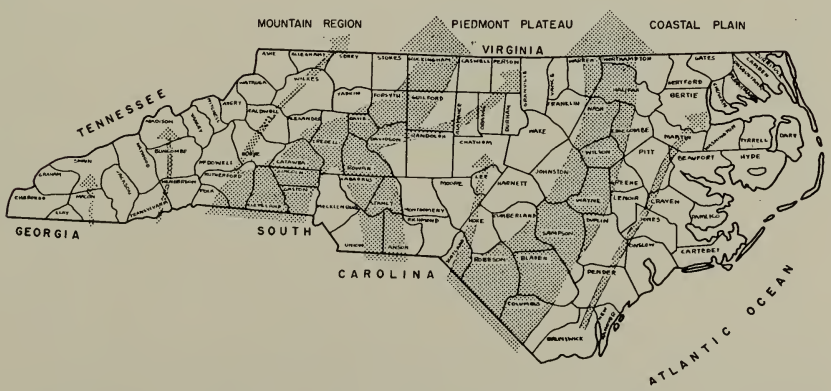


FIGURE 11. Mourning dove concentration areas and migration routes in late winter, as indicated by rural mail carrier roadside census, Jan. 29-Feb. 2, 1951. The two major dove routes correspond directly with the two belts of cropland shown in Figure 10 above. (Based on 589 carrier-reports throughout State and 30,036 miles of driving.)

The migratory wave now rolls southward, usually with astonishing speed. The peak concentrations are much reduced by the middle of September and continue to decline sharply to the low point of the year in October. Good populations are frequently present into the third week of September, however, and there are almost always more doves present throughout September than in October.

Yearly Variation

The ebb and flow of populations and activities with the changing seasons are remarkably constant from year to year. Deviations of a week or two do occur, in relation to weather conditions, nesting success, and the size of the total population.

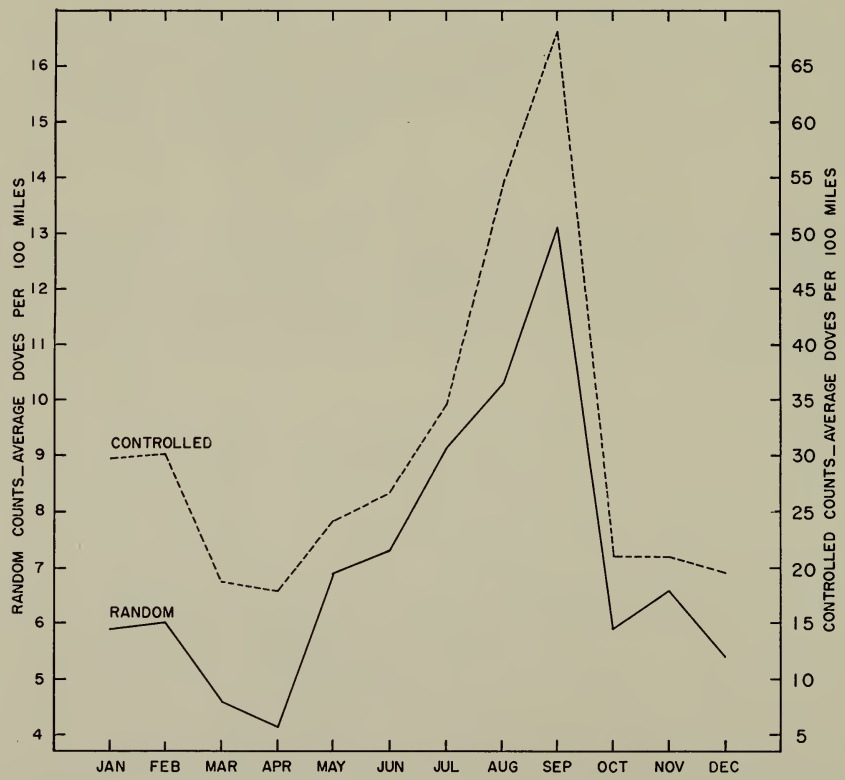


FIGURE 12. Average monthly population trends, as shown by roadside counts. The peak populations of August and September are rapidly diminished by strong southward migrations. (In this graph, the random counts are averages for 1949-1952, based on 350,319 miles of driving; the controlled counts are averages for 1950-1952, based on 14,825 miles.)

But the time and course of major events can be expected each year on about the same schedule.

It is known, for instance, from a mourning dove study conducted in North Carolina during 1939-1942, that the time of the annual fall exodus has been the same for at least the past

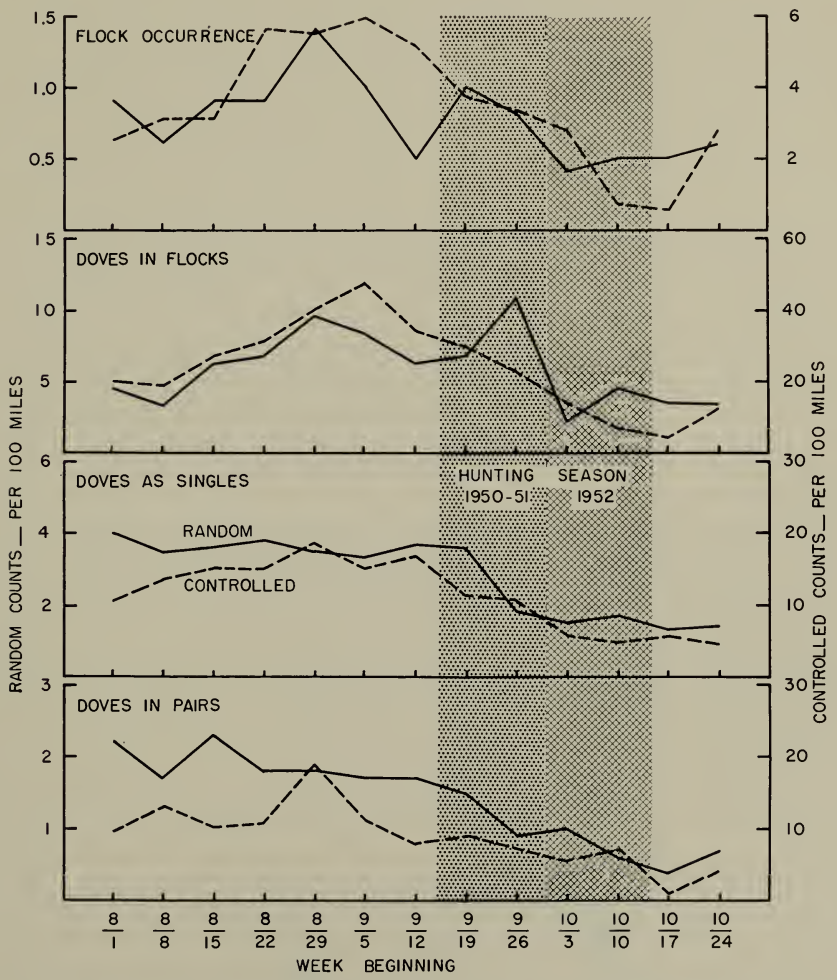


FIGURE 13. Average weekly population trends, August-September-October, as shown by roadside counts. Flocking rises to a peak in late August and early September, as both local doves and doves from more northern states start moving southward. Mid-October brings the lowest dove populations of the year. (The random counts are averages for 1950-1952, based on 103,979 miles of driving; the controlled counts are averages for 1951-1952, based on 4,500 miles.)

fifteen years (Quay, 1951). Quotations from the report of this earlier study are descriptive, as follows (*ibid.*, pp. 71-72):

For the Raleigh region:

> During the second week of September the dove population showed a marked decrease from the previous week's findings. On September 12 the numbers of doves had diminished almost to one-half, and by September 15 the flocks had virtually disappeared. Collecting trips were taken on September 22, 23, 25, and 28 and not a single dove was seen during those four days in the field. On October 16, after a few days of cold weather, a flock of 65 doves was found. However, large groups of doves were not common until November 15. The previous week was one of extremely cold, rainy weather, which was followed by a mass flight of doves into this vicinity.

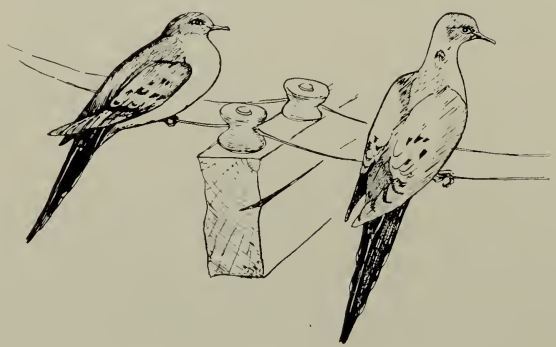
For the northern Coastal Plain:

> In the early days of September, as if by a signal, practically all of the birds disappeared about the same time. During the latter part of September and all of October, it became almost a novelty to see even one bird.

For the Mountains:

> The locally-raised doves were in flocks from mid-summer to September 1. They began to leave around August 15 and by September 1 the flocks had entirely disappeared.

These accounts were for 1940, a low year for mourning doves. The pattern was essentially the same, however, in all three years of the investigation.



Annual Production

Size of Nesting Population

Nesting goes on from March to September, but not at a uniform rate. Male mourning doves call or "coo" regularly while engaged in courtship and nesting activities. Cooing is especially persistent early in the morning, so that censuses of cooing birds during the first two hours of sunlight give a direct index to the total numbers nesting at any particular time (McGowan, 1953). Repeated coo counts from April to August, made over established routes and under standardized conditions, show that the peak of nesting activity occurs during May and early June (Figure 14). Accordingly, a breeding index thus obtained is a dependable reflection of the maximum breeding population. Calling intensity parallels the number of birds calling, thereby providing a double check. Such relative indices, when compared from one year to the next, demonstrate whether the total breeding population is rising or falling.

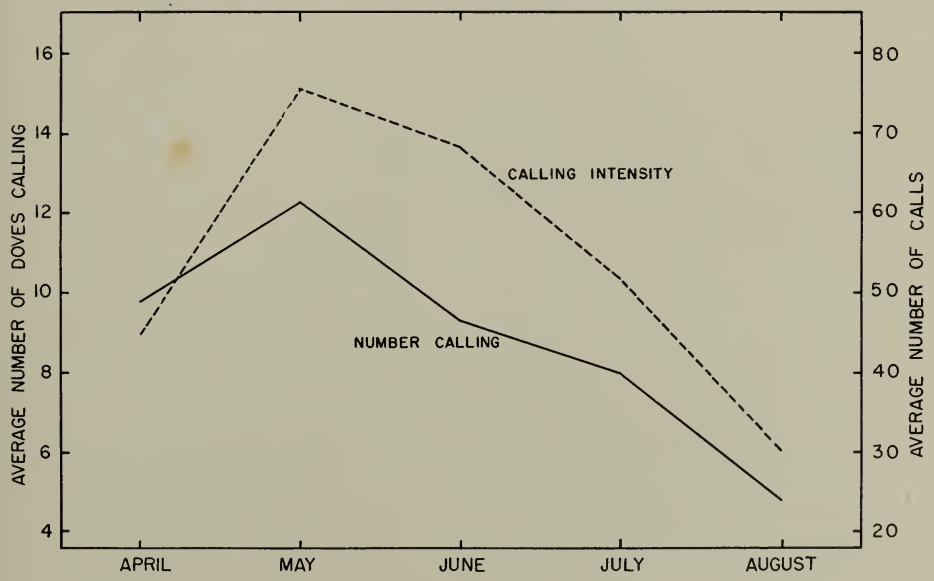


FIGURE 14. Time and relative intensity of breeding, as shown by the average results of the 1951 early morning call-counts—two in each of the three major regions of the State. The early May to mid-June period is the best time to use this method of determining the relative size of the breeding population.

Production of Young

As the nesting season progresses the proportion of new birds of the year increases. The higher the percentage of new birds, the more successful the season. And good hunting in the fall is largely dependent on good production in the summer.

It has already been shown, in the previous chapter, how the total population rises during the summer. The particular way in which the young of the year contribute to this is best revealed by the three and one-half years of trapping records (Figure 15).

Based on the 1949-1953 period, the average development by months is as follows: While a few immature birds are found all winter, for all practical purposes the population is 100% adult in March. Some new young appear in April, but the first real increment comes in May. The big increase comes in June, when the outpouring of young from peak nesting activity greatly enlarges the proportion of young in the whole population. The level

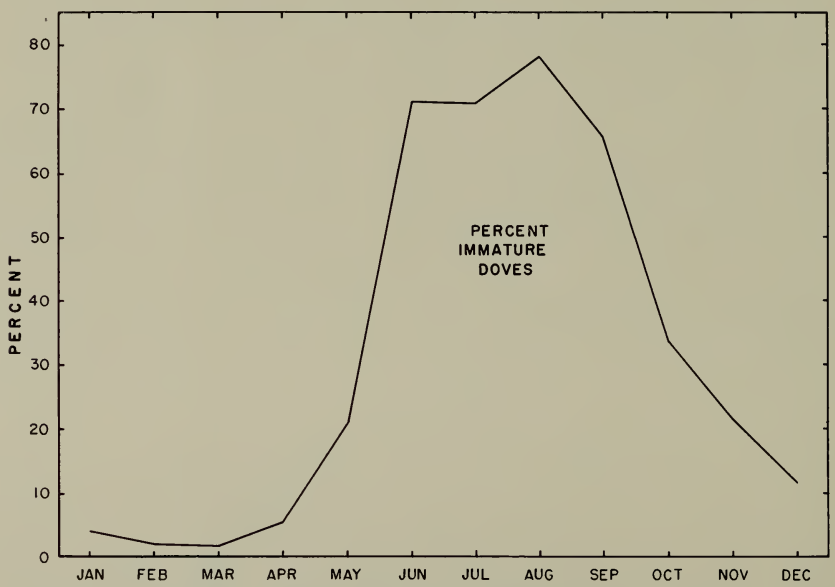


FIGURE 15. Average monthly percentages of immature birds among the 7,993 mourning doves trapped from August 1949 to February 1953 at all stations. April, May, June, and July are the principal nesting months, with considerable numbers of young still being fledged in August and possibly 10% of the season's total in September. The young produced in April and May are flocking together in fields by June and thus are available for trapping and observation. (The percentages in this graph include both locally-raised and migrant doves, since separation of these two groups is not possible by present methods.)

remains the same in July and moves up only slightly in August, as southward drift and natural mortality roughly balance new production. A sharp decline begins in September as the result of the combined effects of the closing of nesting, attainment of adult plumage by birds produced in April and May, and southward migration.

FIGURE 16. Dove wings. Immature doves (above) have white-tipped wing feathers. Adult plumage (below) is reached at about four months of age, with the loss of the last white-tipped feathers at the front of the wing. This method of separating young from adult is useful in studying age ratios and annual production.

It should be remembered, in considering these monthly proportions of young as determined by trapping, that there is a lag of three to five weeks between the time a dove is hatched and the time it becomes exposed to trapping. There is at least the same interval between hatching and exposure to the gun, though this becomes important only with late-season young.

FIGURE 17. Swollen crop of breeding dove. The presence of "pigeon milk" in the walls of this exposed dove crop means the bird was in breeding condition.

In individual years, the June proportion of young may be higher than July, and equal to August. A good index to local production may be obtained, therefore, as early as June. Production can be expected to continue at a high rate in July and August, if nesting conditions do not change greatly. Comparisons between years will test the trends of nesting success.

Percent of immatures at the height of the nesting season gives the degree of local production, but not the relative size of the total population. The decline in the percent of immatures in early fall is, of course, paralleled by an equal and opposite increase in the total number of doves present and abroad in the fields, as the young birds mature and migration sweeps through the State.

Production and the Hunter's Bag

The proportion of young doves in hunters' bags during the early-fall hunting season provides a final check on the health and trend of the whole population over its entire range. The hunter-take in the September season has been considered a fairly good cross-section, because at this time in the southeastern states there is a mixture of all types—adult and young, local and transient. Actual production, however, is higher than that measured on this basis, because the early-season young are then counted as adults and the crest of the migration wave is already

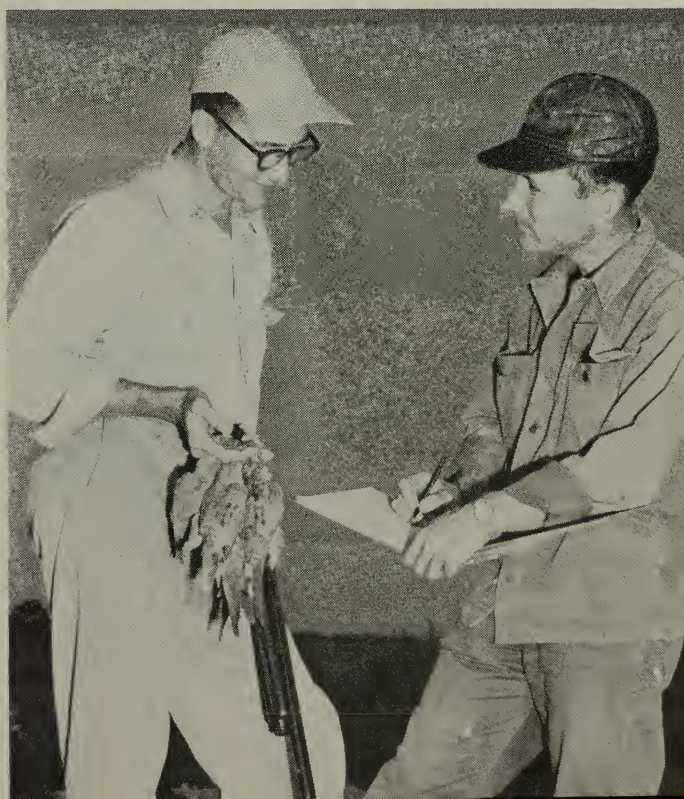


FIGURE 18. Hunter bag checks by Commission biologists give direct information on the success of the hunting season and the size and condition of the dove population. Such information is used in both short-range and long-range management plans.

past. The September bag is also a good check on the extent of late-season nesting.

The make-up of hunters' bags during the last five September seasons in North Carolina, as sampled in a number of Piedmont and Coastal Plain counties each year, was as follows:

TABLE I

Age Ratios in September Bags

Date of Bag Check	Number of Doves Checked	Percent Immature	Percent Adult
1948, Sept. 16-18	706	73.2	26.8
1949, Sept. 16-30	1671	71.2	28.8
1950, Sept. 16-30	1943	60.3	39.7
1951, Sept. 15-19	962	52.5	47.5
1953, Sept. 15-29	1812	61.4	38.6
Total and Averages	7094	63.7	36.3

These figures suggest a declining population from 1948 to 1951, with some comeback by 1953. This is exactly what the evidence from all other sources indicates, both in North Carolina and in other eastern states. The return to the more favorable production trend clearly began in 1952, but the season that year was in October and so the figures are not comparable. Further details and possible explanations of these year to year trends will be given later under "Population Turnover."

Hunting and Hunter Success

The mourning dove is a popular game bird throughout the southern half of the United States. Twenty-eight states had open seasons in 1953-54. The mourning dove is, in fact, the third most heavily-shot game bird in the country, being exceeded only by the bob-white quail and the ring-necked pheasant. Byron Dalrymple, in his interesting book on dove shooting (1949), estimates the legal kill to be at least 15,000,000 each year. Illegal kill apparently adds to this considerably.

The "Gray Bullet," as Dalrymple justifiably calls this fast-flying target, is an especial favorite in the southeastern states. The annual legal kill in several of these states was estimated at 1,000,000 to 2,000,000 birds each in the low years of 1950 and 1951 (*Cooperative Study,* 1952). It has been the purpose of the current regional project to investigate the possibilities and means of maintaining and even improving upon this harvest.

Seasons and Areas

Most of the dove hunting in North Carolina takes place in the early-fall season. Doves are widespread at this time and there is dove shooting in all parts of the State. The fewest doves and the least hunting are in the Mountains. The heaviest hunting is, of course, in the best agricultural areas of the Piedmont and Coastal Plain. In these regions, extensive dove shoots are planned and held regularly. All types of hunting go on, however, down to one-man jump shooting.

There is very little dove hunting in North Carolina, on the other hand, in the mid-winter season. Doves are usually too few and too shifting in January for hunts to be organized with much expectation of success. Occasional shoots are held some years in the best dove areas. Such shoots often yield higher than average kills, because they take place only at times and places of unusual concentrations. The greatest total numbers of doves in winter are found in the central Piedmont and upper Coastal Plain. There is evidence, however, that some of the best concentrations for shooting purposes occur in the wide corn and soybean fields of some of the coastal counties.

Behavior of Doves Under Hunting Pressure

The behavior of doves under gun pressure follows a definite pattern. Hunting is uniformly good the first day. The doves be-

come confused but keep coming in and returning over the hunters regularly and persistently. Limits are often killed within an hour or two on the best fields.

Hunting continues to be good on the second day, though the kill may be less. A longer time is required to down an equal number of birds, as the flocks break up into smaller groups and come into the fields later in the day.

On the third straight day of hunting most of the birds stay out of the feeding fields until almost sundown. When they do come they are flying high and as singles, twos, and threes. Kills are usually lower after the first two or three days, especially if there are not enough hunters to keep the birds moving. The majority of the flock present on opening day may sometimes leave the area but more often merely change to less attractive fields in the vicinity. They frequently return to the original fields a few days later if there has been no further shooting.

This fixed reaction of doves to hunting means that each general shooting site can support several good hunts in a two-week season by letting the birds rest and regather for a few days after each shoot. Mourning dove hunters in North Carolina appear not to be taking full advantage of these possibilities. By far the greatest amount of dove hunting in recent years has been on the first three days. Most hunters have been putting away their guns after this first scattering of the birds. Good concentrations of doves, therefore, on the same or nearby fields, have largely gone unshot the rest of the season. This situation probably accounts, in part at least, for the relatively small harvest of mourning doves in North Carolina as compared with states farther south.

Hunter Success

How many dove hunters are there in North Carolina? What is the average daily bag; the season's bag? The answers to these and related questions have been sought in this study by hunter bag checks each season and by special questionnaires.

The best information on the number of hunters and the total kill comes from an all-species questionnaire for the 1951-52 season. This questionnaire sampled 4.5% of the North Carolina resident hunting license holders. Two mailings and a personal interview follow-up were conducted. The results showed that about 11% of the licensed hunters killed doves that year. Careful statistical analysis placed the total kill at 395,829. These fig-

FIGURE 19. These hunters got their limit of eight doves each in about three hours on the opening day of the 1953 season.

ures, and the statistical methods used, can be found in the *Pittman-Robertson Quarterly Report* of the North Carolina Wildlife Resources Commission for March 1954. This estimated kill of nearly 400,000 doves is four times larger than the best previous estimate (Stains and Barkalow, 1951, for the 1949-50 season), and reveals a much greater interest by hunters in mourning doves than hitherto suspected. It is all the more remarkable in view of the fact that the 1951 dove population was the lowest of recent years.

According to hunter bag checks in the fall seasons from 1948 to 1953, the average dove hunter in North Carolina on each trip hunted from 2.5 to 3 hours and bagged from 2.9 to 5.3 doves. Averages possibly do not tell the story too well. For instance, 41% of hunters on completed hunts in September of 1953 killed their daily limit of 8 doves each.

The kill per gun-hour is one of the most direct yardsticks of hunter success. North Carolina hunters bagged 1.6 doves per hour in 1953. This number is about average for the past six seasons and compares favorably with other states.

A mourning dove hunt can be a furious event. The number of doves bagged is quite a different matter from the number of shells fired, because misses are more frequent than hits in mourn-

FIGURE 20. Freedom of view and movement are more important than cover in mourning dove shooting.

ing dove shooting. Ken Wilson, one of the Commission's biologists, reported a hunt in Warren County that may be called typical (Wilson, 1952). Twenty-two hunters fired 452 shells and brought down 88 doves, or one dove every five shots! One "expert" got eight doves in 14 shots. One "optimist" got no doves in 15 shots. But they all had fun.

One of the main attractions of the early dove season undoubtedly is the chance for limbering up and sharpening the shooting eye after the long layoff. A good dove hunt affords lots of shooting, at fast-moving targets. What better warm-up is there for the regular fall hunting soon to follow?

Population Turnover

Early Numbers

Satisfactory records are not available on the early abundance of the eastern mourning dove. In the Southeast, baited fields and the one-crop system encouraged large but widely separated concentrations. The change during the 1930's to many new and different crops allowed the doves to spread out more evenly, especially in the fall and winter. For these reasons, comparison of today's dove population with that of earlier years is most difficult.

In January of 1940 severe freezing temperatures and deep snows covered the Southeast for over a week. The general dove population suffered heavy losses, immediately noticeable in the 1940 and 1941 hunting seasons. Recovery has never been complete, though it was improving by 1948 when the Cooperative Study was begun.

The 1949-1953 Years in North Carolina

The four years of the Dove Study in North Carolina were a period of relatively low and uneven populations. The best hunting year was 1949. There were more doves in the State in the fall of 1950 than in 1949, but the hunting was not as good. The percentage of juveniles in hunters' bags was less, indicating poorer production. This may have been due, however, to the almost complete migration out of the State by opening day of the large concentrations of late August and early September. By opening day, this would have left a population composed largely of recently-fledged young, breeding adults, and adults only recently finished with nesting. This explanation is supported by the information from trapping, general observations, and the ages of the young birds in the hunters' bags.

There was poor carry-over during the winter of 1950-51, leaving a breeding stock far below that of 1949 and 1950. Both production and the total fall numbers sank to their lowest points in 1951, as did the size of the hunter's bag. The primary cause of these losses appears to have been trichomoniasis, a protozoan disease of the throat and chest. This disease was widespread in 1950 and 1951, becoming epidemic in some states. It occurred

in all parts of North Carolina, but apparently was not as serious here as in many other parts of the range.

Survival over the winter of 1951-52 was unexpectedly good. In the spring of 1952, a larger nesting population got off to an earlier start than usual. Production returned to normal. The fall population was definitely improved over the 1951 low. The general increase continued in 1953 and hunter success was the best since 1949.

Annual Mortality

Recoveries of banded birds shot or found dead give the most reliable estimates of the numbers and percentages dying each year. The North Carolina sample of 211 such recoveries includes 164 banded in the State and 47 banded in eleven other states but retaken here. By accepting these recoveries as a normal sample of the entire population, the annual mortality rates may be calculated as in Table II below.

TABLE II

Annual Mortality and Longevity of Mixed Dove Population. Based on 211 band recoveries to March 15, 1953, from all doves banded before January 1, 1953. Sample composed of 110 banded as young, 75 banded as adults, and 26 at unknown ages. Mean annual mortality rates according to Lack's formula (1948:266). Life expectancy according to Farner's formula (1949:76).

Year After Banding	Number Dying Each Year (Recoveries)	Number Alive At Start Of Each Year	% Of Total Alive At Start Of Each Year	% Of Year's Population Dying Each Year (Annual Mortality Rate)	Life Expectancy On Jan. 1, In Years
0-1	167	211	100.0	79.1	0.64
1-2	29	44	20.9	65.9	0.93
2-3	6	15	7.1	40.0	1.96
3-4	3	9	4.3	33.3	2.47
4-5	3	6	2.8	50.0	1.44
5-6	3	3	1.4	100.0	-------

Mean annual mortality, 0-6 years: 73.3%

Mean annual mortality, 1-6 years: 57.1%

Mean natural longevity: 0.76 years

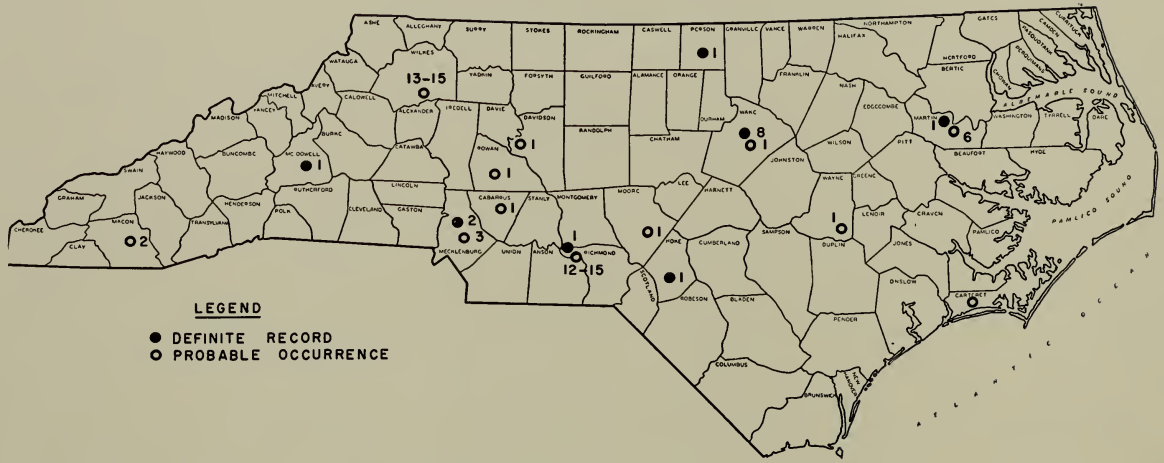


FIGURE 21. Trichomoniasis in mourning doves, 1949-1952. The numbers by the symbols indicate known occurrences. While the known incidence of this disease was not severe in North Carolina, it reached epidemic proportions in Alabama and some other states in 1950-1951.

On the basis of these figures, nearly three-fourths (73%) of North Carolina doves die from all causes each year. The heaviest loss is during the first year of life—about 85%. The adult death rate after the first year is about 57%. Thus, the life expectancy of each dove that leaves the nest is less than one year, and also less than one year more for each dove that survives the first year. These figures are very close to those of Austin (1951:169) for the Cape Cod region of Massachusetts. They are somewhat higher than those for the southeastern United States as a whole, where the mean annual mortality rate (0-6 years) is 68% (*Cooperative Study,* 1952).

By combining the mortality rates in Table II for the first and second years after banding, it is seen that the population "turnover" is 93% complete every two years. Such a rapid turnover rate gives a delicately balanced game population, capable of gaining ground only slowly under favoring conditions but of losing ground rapidly under adverse conditions. In a stable population, production will equal loss; but as shown in the review of past years, dove populations are rarely stable.

If it is assumed that an average yearly loss of 70% is correct, then each nesting female must produce 4.6 young during the season to bring the early fall numbers back to the previous year's level. This means two to three successful nestings by each pair. Several studies in various parts of the range (Nice, 1952:55-56) show that the natural production rates under normal conditions are just about equal to this theoretically required rate of replacement. Greater losses or lower production, however, will send the population trend downward.

Mortality Due to Hunting

Judging again from the recoveries of banded doves, the reported mortality due to hunting in the country at large is 3%. (The same figure for North Carolina alone is 1.5%, though the sample here is smaller and less certain.) But it seems true that hunters report no more than one-half the bands taken, which raises the estimated mortality from legal hunting to 6%.

No special studies of the illegal kill have been made. It is the general feeling of some dove biologists, nevertheless, that the illegal kill may be equal to that taken within the bounds of the game laws.

Crippling losses are high in dove shooting, probably higher than for any other game bird. In North Carolina, crippling-loss

counts on shooting fields have varied between 15% and 30% of the actual bag. For the southeastern region there is some reason to believe that the number of fatally-wounded but unretrieved birds may approach the legal kill.

The total annual mortality due to the gun, then, may amount to 15% or 20% of the entire population. On the basis of the present evidence, however, this would seem to be a very liberal estimate. It well may be less. This is an area of study that needs more refined analysis.

Natural Mortality

If 70 out of each 100 mourning doves die annually from all causes, and only 20 of these fall to the gun, what are the causes of death among the remaining 50 birds? The only answer appears to be natural factors, such as bad weather, starvation, disease, accidents, and predation. It is known that these are some of the important factors, but it is not known very well just how, when, and to what extent each one works.

There are some leads. There is strong indication, for instance, that the greatest natural mortality takes place during the first few weeks after leaving the nest. Young doves banded early in the nesting season are strangely lacking in the hunting season recoveries. This suggests that possibly very little can be done about this 50% loss even if and when more is learned about it. And learning about it is a challenging necessity, for at the present time this large and unknown, or *unmeasured,* cause of mortality is probably the single most important unsolved problem facing mourning dove management.

Management

Mourning dove management has both state and national aspects. Since the dove is migratory, its overall regulation comes under the supervision of the Federal Government, as required by the Migratory Bird Treaty Act of 1918. The information for the establishment of the national dove laws is gathered each year by the individual states and various conservation agencies. Each state is then permitted to recommend to the United States Fish and Wildlife Service a season or seasons within the regional limitations established by this national agency.

The Fish and Wildlife Service annually sets the dove hunting season and the bag limit on the basis of current year's production and the trend of the total population over the entire range. The goal is to carry enough birds over the winter to give adequate breeding stock for the new year's crop. The several research programs of the Cooperative Mourning Dove Study have not only provided essential facts on mourning dove populations but also have developed methods for determining annual trends. These methods are already in use. They will probably be modified from time to time in accordance with experience and further study in their application.

No single state can give dove management recommendations suitable for the whole country or even for the Southeast. The extensive range, numerous population segments, long breeding season, rapid migrations, and high mortality rates bring about varying populations in different seasons and areas. This is why the individual states are allowed some latitude in the choice of hunting season dates. This is also why the season in each state must be placed at a time fair to all the other states.

When are the best times to hunt doves in North Carolina? Under present population levels at least, most of North Carolina can not expect any appreciable hunting in a mid-winter season. The same would be true of the late-fall months. This is because this State is north of the heaviest wintering concentrations and also because the doves present here at these times are much scattered and very fluctuating in numbers and distribution.

North Carolina has had a dove season in the last half of September since 1940 (except for 1952 when it was the first half of October). These seasons have been reasonably successful, but not as fruitful as the later seasons of the more southern states. Dove populations and movements in the Southeast, as revealed

by the Cooperative Study, indicate that an early-fall season would continue to provide the best dove hunting of the year in North Carolina.

A problem of early-fall dove shooting everywhere is that a small percentage of the adults are still breeding. The exact importance of this late breeding to the whole population is not yet clear.

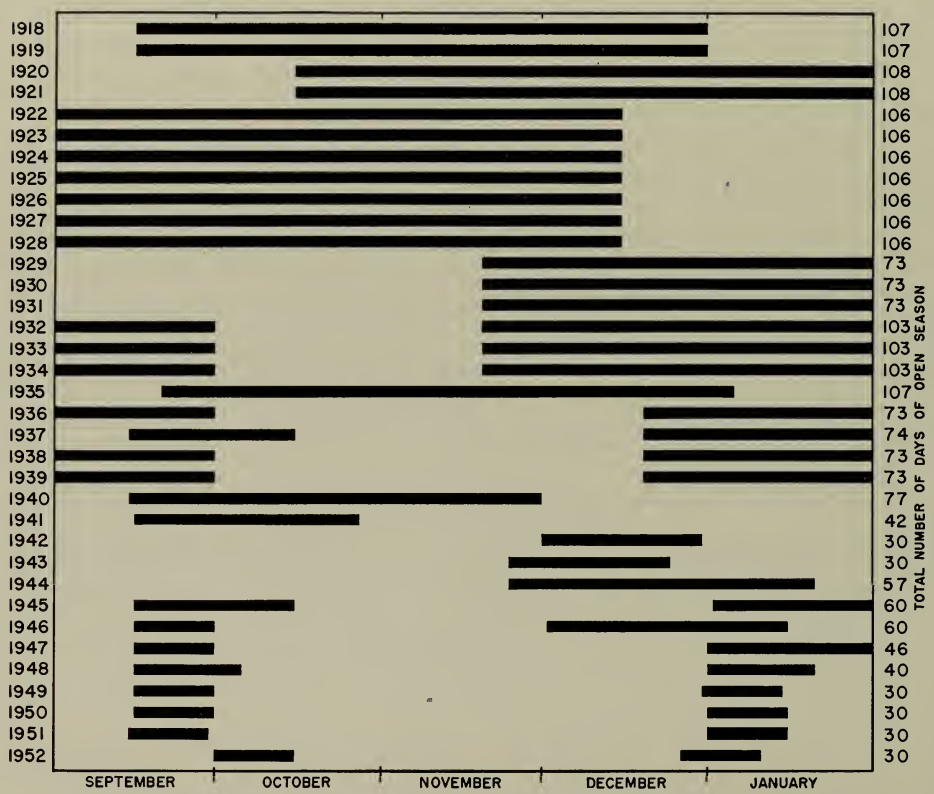


FIGURE 22. Mourning dove hunting seasons in North Carolina, 1918-1952. Length of season shortened by number of included Sundays each year and by half-days since 1947. The shortening seasons are vivid testimony to the decreasing numbers of doves and the increasing numbers of hunters, and point to the pressing need for the development and application of workable management procedures. During the past 36 years, the season has been decreased from 107 whole days to 30 half-days, and the daily bag from 25 to 8 birds.

FIGURE 23. Excellent dove habitat. The wheat stubble in the foreground, the corn in the background, and the annual weeds in between all supply favorite foods, and the pine trees afford resting cover.

Some more definite answers can be expected when all the banding records from the entire Cooperative Study have been received and analyzed.

Dove management leans heavily at the present time on hunting regulation and law enforcement. There are two principal reasons why this is necessary. The first is that so far the only controllable mortality factor is the one due to hunting. The second is that many of the standard management procedures in use for other game birds and animals are not practical with

FIGURE 24. A good watering place. Over 2,000 mourning doves were watering in this drying lake-bottom near Raleigh each afternoon during late August and early September, 1953.

doves. Neither predator control, restocking, nor special refuges seem to have any useful or economic place in mourning dove management.

One management practice that can be applied to mourning doves is the kind of local habitat improvement used in farm-game programs. In this sense, the mourning dove is unique in being a *migratory* farm-game species. It was noted earlier that doves tend to return to the same area from one season to the next and that concentrations remain longer in the better places. While a given dove population can not be kept in the same area indefinitely, there is every indication that local attention to the basic needs and habits of the dove can make the difference between good and poor local shooting. This provides a management opportunity, for North Carolina is blessed with extensive farmland and diversified agriculture.

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APPENDIX. Favorite mourning dove foods in North Carolina.

WHEAT

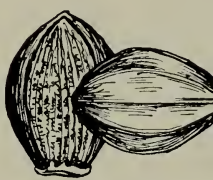
POKEWEED

FOXTAIL

GALINGALE

RAGWEED

SMARTWEED



BULLGRASS

CRABGRASS

SOYBEAN
and
COWPEA

CORN

PEANUT

CROTON